

## Systematic Review

# Laparoscopic extravesical ureteral reimplantation (LEVUR): a systematic review

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**Background:** Laparoscopic ureteral reimplantation is a feasible method for treating ureteral pathology with good preliminary results in the literature. In this study, we review medium term results for laparoscopic ureteral reimplantation and discuss current developments of this procedure.

**Methods:** Medline and Embase databases were searched using relevant key terms to identify reports of paediatric laparoscopic extravesical ureteral reimplantation (LEVUR). Literature reviews, case reports, series of <3 children and adult studies (age >20 years) were excluded.

**Results:** Five studies were assessed, overall, 69 LEVUR were performed in children. Despite different surgical technique, in all case the technique was respected. Patient demographics, preoperative symptoms, radiological imaging, complications, and postoperative outcomes were analyzed. Median success rate was 96%. Complications were reported in five cases.

**Conclusions:** This study is limited by the data given in the individual series: varied criteria used for patient selection and outcome as well as inconsistent pre- and post-operative imaging data precluded a meta-analysis. But it demonstrates that the laparoscopic ureteral reimplantation is an effective procedure with good medium-term results. We believe that in well selected patients this procedure will become an established treatment option.

**Keywords:** Laparoscopy; ureteral reimplantation; medium-term outcome

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## Introduction

Clinical indications for ureteral reconstruction include strictures, trauma (often iatrogenic), vesicoureteral reflux (VUR), fistulas, and malignancy (1-3). Short ureteral defects can be managed by ureteroureterostomy, or ureteroneocystostomy. Longer defects require complex procedures such as psoas-hitch ureteral reimplantation often combined with a Boari flap. Traditionally, open ureteral reimplantation has been the gold standard for ureteral reconstruction (1,2,4-6). Laparoscopy provides patients the advantages of quicker recovery, low post-

operative morbidity, less postoperative pain, less blood loss and better cosmesis (7,8). Successful results using laparoscopic ureteral reimplantations have been reported in the literature to treat ureteral strictures, iatrogenic injuries, VUR, and ureterovaginal fistulas (8,9). It demonstrates that laparoscopic ureteral reimplantation has comparable functional outcomes to open surgery (8). However, in reconstructive surgery early reported success rates can be misleading and the long-term outcomes are important in assessing the efficacy of the procedure. In this study, we review medium-term outcomes of laparoscopic ureteral

reimplantation and discuss current developments of this procedure.

## Methods

Medline and Embase databases were searched using relevant key search terms (laparoscopic, vesico-ureteral, reimplantation). No publication date limits were applied and the final search was performed on August 30, 2016. Literature reviews, individual case reports, exclusively adult studies (age >20 years), and small case series of fewer than three paediatric patients were excluded. Paediatric data from combined adult and paediatric studies were included only if it was possible to select out the paediatric data. The procedure was considered successful if (I) the author reported success and/or (II) there was no alternate or subsequent surgical procedure (open or minimally invasive) caused by technical failure 3 or more weeks after the initial procedure.

## Criteria of evaluation

Parameters analyzed included operative time, blood loss, analgesic requirement, complications, time to oral intake, hospital stay, and follow-up. Success was defined as no significant dilatation on ultrasonography and good drainage on radiological contrast studies such as IVU and RGP.

## Results

Five studies were assessed, overall, 69 laparoscopic extravesical ureteral reimplantation (LEVUR) were performed in children. Despite different surgical technique (10), in all cases the technique was respected. Patient demographics, preoperative symptoms, radiological imaging, complications, and postoperative outcomes were analyzed. Median success rate was 96%. Complications were reported in five cases.

The extravesical Lich-Gregoir procedure is used mostly in children to treat high grade VUR and in renal transplant surgery with reported high success rates in the literature (11,12). Lakshmanan and Fung refined the laparoscopic technique and reported 71 cases in children with high grade VUR, and concluded that the laparoscopic technique was comparable to open reimplantation techniques (13). Yohannes *et al.* and Kamat *et al.* performed the procedure in adult patients with post-hysterectomy ureterovaginal fistula, and lower ureteral stricture with the additional advantages

of a minimal invasive procedure (14,15).

Laparoscopic ureteroneocystostomy was completed in all patients without open conversion. The mean operative time was 241 (range, 131–351) min (Does not include additional procedures. For the two ureteral reimplantations during LRP, the trocar placement and ureteral preparation times are included). The mean estimated blood loss was 300 (range, 50–550) mL. No blood transfusion was required (16).

## Discussion

Open surgery remains the gold standard for ureteral reimplantation with good long-term results (success rates over 90%) (1,2,4,5). An initial laparoscopic case series was first reported in children to treat high grade VUR (8,17). Reddy and Evans reported the first procedure in an adult (18). In recent years, more laparoscopic and robotic ureteral reimplantation cases have been reported with good preliminary results in the literature (15,19).

However, in reconstructive ureteral surgery early reported success can be misleading because recurrent strictures typically develop up to 1 year after surgery (20–22). Selzman *et al.* observed an 11% stricture rate after 1 year following open ureteral reimplantations for ureteral injury (23). The median follow-up time was 35 months, which represents one of the longest for a laparoscopic ureteral reimplantation series (9,24). The results are comparable to open surgery with the advantages of a minimally invasive procedure.

## Current developments

The laparoscopic ureteral reimplantation in the pelvis and lower abdomen is technically demanding even for experienced surgeons, and each case offers a different challenge based on the etiology and location of the stricture (11,12).

Despite the difficulties of the procedure, the magnification and high definition (HD) visualization allows a clear identification of the ureter and bladder as well as the surrounding tissues and allows careful manipulation during the operation especially for the secondary cases. The authors used a HD wide view camera system (Karl Storz, Tuttlingen, Germany) after our published first series, and we are in opinion that this definitively better visualization with a large angle has added a great value to our technique. More technical advances will facilitate reconstructive procedures in the future (16).

Laparoscopic ureteral reimplantation requires advanced

laparoscopic skills and this procedure should preferably be carried out in high-volume specialist centres.

Finally, we are of the opinion that the laparoscopic procedure offers similar efficacy to open surgery, and therefore the procedure may become the gold standard in the future. Further comparisons with open surgery and with increased numbers of cases and longer follow-up are, however, warranted.

## Conclusions

Laparoscopic ureteral reimplantation is an efficacious procedure and can be used to correct ureteral pathologies due to many etiologies. Mid-term follow-up results of this procedure are promising. We are convinced that this procedure offers comparable results to open surgery and with evidence from larger series in the future, is likely to become an established procedure.

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## Footnote

*Conflicts of Interest:* The authors have no conflicts of interest to declare.

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